Oceanological and Hydrobiological Studies
International Journal of Oceanography and Hydrobiology
Vol. XXXIX, No. 1

Institute of Oceanography (111-117) University of Gdańsk
ISSN 1730-413X 2010 eISSN 1897-3191

DOI 10.2478/v10009-010-0008-6
Original research paper

Received: *July 03, 2008*
Accepted: *January 13, 2010*

The biodiversity of psammon rotifers in Włocławek Reservoir

Irena Bielańska-Grajner[1,3], Małgorzata Poznańska[2,4]

[1]Department of Hydrobiology, University of Silesia
ul. Bankowa 9, 40-007 Katowice, Poland
[2]Department of Invertebrate Zoology, Nicolaus Copernicus University
ul. Gagarina 9, 87-100 Toruń, Poland

Key words: psammon rotifers, dam reservoir, different sites

Abstract

In total 47 rotifer taxa were found in the psammon of Włocławek Reservoir; 36 at the site in Dobiegniewo and 38 at Dobrzyń. Five species were classified as psammobionts, 14 as psammophiles, and the remaining ones as psammoxens. Psammobionts and psammophiles were observed mostly in the psammon at Dobiegniewo.

The highest density of psammon rotifers was noted in the euarenal zone of the flooded part of the reservoir. However, the highest density in the area near the swift current was noted in the hygroarenal zone. While the flooded part of the reservoir had four dominant species of rotifer: *Lecane closterocerca*, *L. scutata*, *Lepadella patella* and *Cephalodella catellina*, the area near the swift current had only two: *Cephalodella catellina* and *Brachionus quadridentatus*.

The most favorable conditions for the development of psammon rotifers was in the flooded area of the reservoir. In comparison with other dam-reservoirs in Poland, the community of these rotifer types in the Włocławek Reservoir was characterized by considerable species richness.

[3] Corresponding author: *igrajner@us.edu.pl*
[4] e-mail: *mpoznan@biol.uni.torun.pl*

INTRODUCTION

Psammon rotifers have been studied in Poland in selected lakes of the Łęczyńsko-Włodawskie Lakeland (Radwan and Bielańska-Grajner 2001, Radwan et al. 2003), the Mazurian Lakeland (Ejsmont-Karabin 2003), the Bytów Lakeland (Bielańska-Grajner 2001), and the Western Pomeranian Lakeland, as well as in artificial reservoirs in Upper Silesia (Bielańska-Grajner 2004, 2005).

Studies of psammon rotifers in dam reservoirs have been confined to Upper Silesia. The water bodies in question yielded an average of 26 species each. The largest number of 37 was recorded in the psammon of Paprocany Reservoir, while the Goczałkowice and Kozłowa Góra reservoirs had 27 species each, and the Łąka Reservoir had just 13. The mean densities of psammon rotifers in these reservoirs were low ranging from 278 dm^{-3} in Łąka Reservoir to 1131 individuals dm^{-3} in Paprocany Reservoir (Bielańska-Grajner 2005).

The aim of the work was to compare the diversity of psammon rotifer communities living in two different habitats of Włocławek Reservoir, i.e., the floodplain area (with a slow current) and the main area with a fast current.

STUDY AREA

The Włocławek Reservoir is Poland's largest reservoir in terms of area and the second largest in terms of capacity. It was created in the 1970s when a dam was constructed across the Vistula River at km 675. It is classified as a shallow, eutrophic and super-rheolimnic lowland reservoir (Giziński et al. 1989, 2000). Detailed data on the morphometry and hydrology of the reservoir can be found in Głogowska (2000).

Psammon material was collected from the limnic part of the Włocławek Reservoir near Dobiegniewo (at km 660 of the Vistula), i.e., in the floodplain area of the reservoir, and on the opposite side at Dobrzyń (also at km 660), i.e., in the area close to the main current (Fig. 1). Sites located along a transect were designated near each of these localities, i.e., 1 - the euarenal zone 1 m from the waterline; 2 - the hygroarenal area where the water meets the land; 3 - the hydroarenal area which is submerged around 1 m from the water-line. The substratum was comprised of fine-grained sand at site 1 and of coarse-grained material (gravel) with an admixture of silty-clay material at site 2.

The most recent research by Mińkowski (2005) classified the water in the Włocławek Reservoir as Class I with regard to total P (mean 0.23 mg l^{-1} P), and orthophosphate phosphorus concentration (0.06 mg l^{-1} $P\text{-}PO_4$), and as Class II with regard to total nitrogen (3.50 mg l^{-1} N).

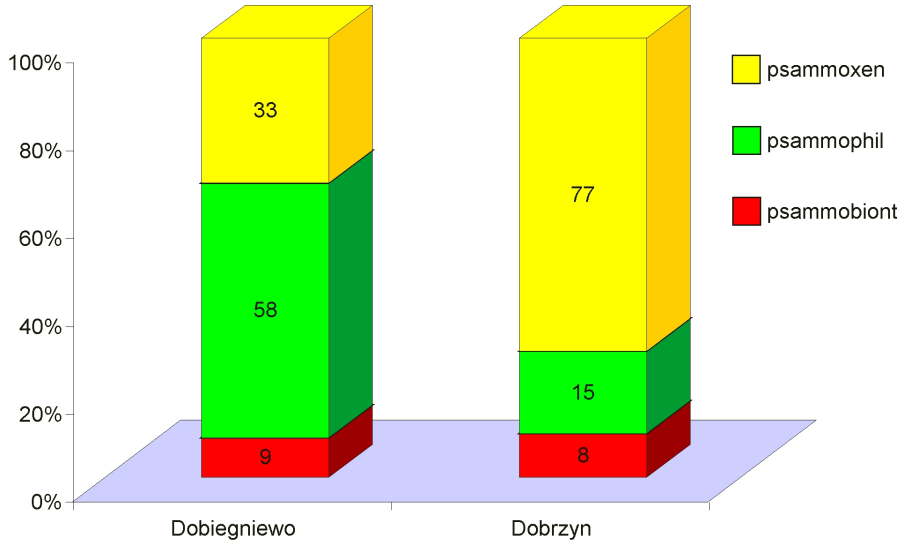

Fig. 1. Percentage of ecological species type comprising the total number of rotifer species.

MATERIALS AND METHODS

The psammon material was collected with a plastic cylinder 3.6 cm in diameter and a sharpened edge. Five samples were taken from each site, and the sand core was divided into two (0-1 and 1-2 cm) layers.

The rotifers were rinsed from the sand by briefly mixing them energetically with distilled water and then concentrating them to 50 ml. Each sample was them divided into five live subsamples and five subsamples fixed first in Lugol's solution and then formalin. The mean numbers of individuals from the sub-samples were expressed per dm^{-3}.

The Shannon diversity index (Błędzki 2007) was calculated using the MVSP program.

RESULTS AND DISCUSSION

The psammon of Włocławek Reservoir included a total of 47 rotifer taxa. There were 36 at Dobiegniewo and 38 at Dobrzyń (Table 1). The two sites differed as regards the role of the ecological groups; while 58% of all the rotifers at the Dobiegniewo site were psammophiles, 77% of those at Dobrzyń

Table 1

Alphabetical list of dominating rotifers (D > 1) collected in Włocławek Dam Reservoir. D – Percentage of dominant, EST – Ecological Species Type: Pb – psammobiont, Pph – psammophil, Px – psammoxen.

Taxa	Dobiegniewo	Dobrzyń	EST
	D %	D %	
Bdelloidea n. det.	1	1.5	
Brachionus calyciflorus Pallas	< 1	4.4	Px
Brachionus quadridentatus Herm.	< 1	15.7	Px
Cephalodella catellina (Müll.)	10.5	20.3	Pph
Cephalodella gibba (Ehrb.)	5.2	3.4	Pph
Cephalodella gracilis (Ehrb.)	< 1	1.6	Pph
Colurella adriatica Ehrb.	1.7		Px
Colurella colurus (Ehrb.)	1	2.6	Px
Colurella hindenburgi Stein.	1.5	3.2	Px
Colurella obtusa (Gosse)	1.8		Px
Dicranophorus hercules Wiszn.	1.3	1.3	Pb
Euchlanis dilatata Ehrb.	< 1	4	Px
Keratella cochlearis (Gosse)	1	2.5	Px
Keratella quadrata (Müll.)		5.1	Px
Lecane closterocerca (Schm.)	21.2	1	Pph
Lecane luna (Müll.)		3.2	Px
Lecane psammophila (Wiszn.)	2.6	< 1	Pb
Lecane scutata (Harr.i Myers)	17.3	5.3	Px
Lepadella patella (Müll.)	16.3	2.7	Pph
Philodina acuticornis Donner	6.6	< 1	Px
Polyarthra vulgaris Carlin		1.7	Px
Proales minima (Monet)	2.3		Pph
Rotaria rotatoria (Pallas)	< 1	4	Pph
Trichocerca taurocephala (Hauer)	4.9	7	Pb

were psammoxens. The shares of psammobionts were similar at the two sites (Fig. 1).

A greater density of psammon rotifers was observed in the beach substratum of the floodplain area of the reservoir, where the greatest density was noted in the euarenal area. In contrast, the highest density close to the main current at this site was in the hygroarenal area (Fig. 2).

The density of psammon rotifers in Włocławek Reservoir was similar to that in dam reservoirs in Upper Silesia (Bielańska-Grajner 2005). As in the

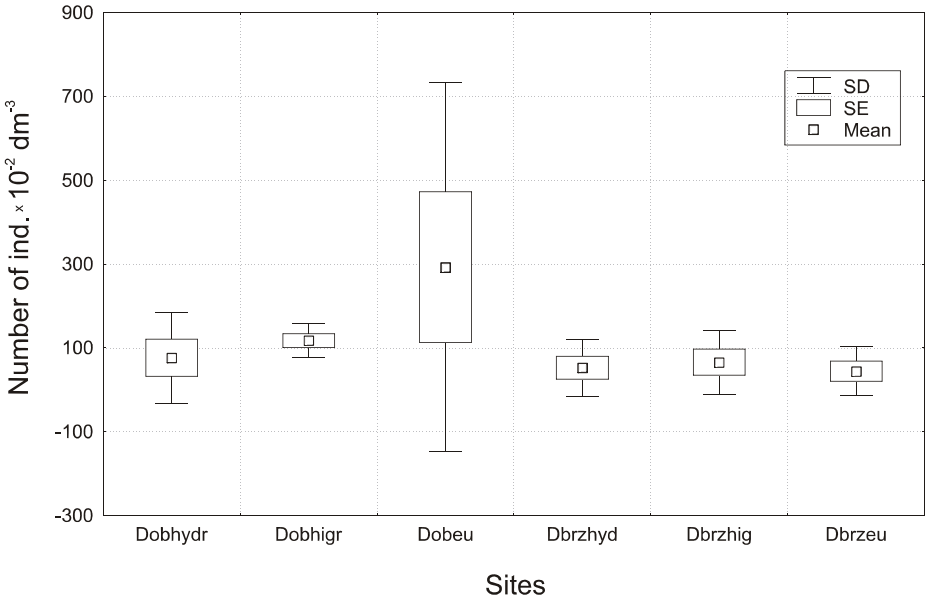

Fig. 2. Differentiation of mean densities (for the study period) of psammon rotifers among particular sites examined in the reservoir: Dobhydr – Dobiegniewo hydroarenal; Dobhigr – Dobiegniewo hygroarenal; Dobeu – Dobiegniewo euarenal; Dbrzhyd – Dobrzyń hydroarenal; Dbrzhig – Dobrzyń hygroarenal; Dbrzeu – Dobrzyń euarenal.

lakes of the Western Pomeranian Lakeland and in anthropogenic reservoirs (Bielańska-Grajner 2005), psammon rotifers were present in greater abundance in the studied reservoir at depths of 0 to 1 cm in the sand.

While psammon in the floodplain part of the reservoir was dominated by the four rotifer species *Lecane closterocerca*, *L. scutata*, *Lepadella patella*, and *Cephalodella catellina*, the part close to the main current had just two dominants: *Cephalodella catellina* and *Brachinus quadridentatus*. The psammoxens at the site close to the main current included a large number of planktonic species that were probably noted in the psammon because they had been transferred there by the current.

The psammon at Dobiegniewo differed from that at Dobrzyń in the greater shares of psammophile species (Table 1).

At both the Dobiegniewo and Dobrzyń sites the hygropsammon was characterized by the highest Shannon diversity index values at 2.5 and 2.6, respectively (Table 2).

Table 2

Shannon diversity index, evenness, number of species at investigated sites

Site		Index	Evenness	Num. Spec.
Dobiegniewo	hydropsammon	2.156	0.708	21.000
Dobiegniewo	hygropsammon	2.572	0.790	26.000
Dobiegniewo	eupsammon	2.045	0.662	22.000
Dobrzyń	hydropsammon	2.381	0.782	21.000
Dobrzyń	hygropsammon	2.625	0.826	24.000
Dobrzyń	eupsammon	2.140	0.772	16.000

The assemblage of psammon rotifers in Włocławek Reservoir was characterized by markedly greater diversity than those of dam reservoirs in Upper Silesia (Bielańska-Grajner 2005). Natural lakes in Poland of varying areas had lower values of diversity of psammon rotifers than the reservoir currently studied (Ejsmont-Karabin 2003, Radwan et al. 2003, Bielańska-Grajner 2005).

In the reservoir, psammon rotifers had the best conditions for development in the floodplain zone where the substratum is comprised of fine-grained sand. This zone was found to have more psammobiont and psammophile species at higher densities.

REFERENCES

Bielańska-Grajner I., 2001, *The psammmic rotifer structure in three Lobelian Polish lakes differing in pH*, Hydrobiologia, 446/447: 149-153

Bielańska-Grajner I., 2004, *Preliminary investigations of psammon rotifers in two reservoirs in Upper Silesia*. Oceanol. Hydrobiol. Stud., 33: 37-45

Bielańska-Grajner I., 2005, *Psammon rotifers (Rotifera) inhabiting water reservoirs in selected areas of Poland*. Wyd. UŚ, Katowice, English summary 1- 114

Błędzki L.A., 2007, *Metoda porównania bogactwa gatunkowego i różnorodności gatunkowej*, Bioskop, 2: 20-23 (in Polish)

Ejsmont-Karabin J., 2003, *Rotifera of lake psammon: community structure versus trophic state of lake waters*. Pol. J. Ecol., 51: 5-35

Giziński A., (ed.) 2000, *Hydrobiology of the lower Vistula River between Wyszogród and Toruń. An assessment of the influence of the Włocławek dam on the structure and functions of the river ecosystem*. AUNC, Limnological Papers No 21: 1-117

Giziński A, Błędzki L.A., Kentzer A., Wiśniewski R., Żytkowicz R., 1989, *Hydrobiological characteristic of the lowland, rheolimnic Włocławek Reservoir on the Vistula River*, Ekol. Pol., 37: 359-403

Głogowska B., 2000, *A geographical and hydrological profile of the study area*. [In:] (ed) Giziński A.: *Hydrobiology of the lower Vistula River between Wyszogród and Toruń. An*

assessment of the influence of the Włocławek Dam on the structure and functions of the river ecosystem. AUNC, Limnological Papers, No 21: 11-21

Mińkowski B., 2005, *The influence of Włocławek Dam Reservoir on the quality of the Vistula River waters in the season of 2003/2004,* Master's Thesis. Department of Hydrobiology, Nicolaus Copernicus University, Toruń, English summary, 1-114

Radwan S., Bielańska-Grajner I., 2001, *Ecological structure of psammic rotifers in the ecotonal zone of Lake Piaseczno (eastern Poland)*. Hydrobiologia, 446/447:221-228

Radwan S., Bielańska-Grajner I., Popiołek B., Paleolog A., 2003, *Rotifer communities of ecotones in six trophically different lakes of Polesie Lubelskie Region (Eastern Poland).* Pol. J. Ecol., 51: 225-236